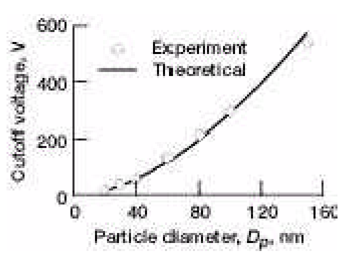
Microscale Particulate Classifiers (MiPAC) Being Developed

The NASA Glenn Research Center is developing microscale sensors to characterize atmospheric-borne particulates. The devices are fabricated using MEMS (microelectromechanical systems) technologies. These technologies are derived from those originally developed in support of the semiconductor processing industry. The resulting microsensors can characterize a wide range of particles and are, therefore, suitable to a broad range of applications.

This project is supported under a collaborative program called the Glennan Microsystems Initiative. The initiative comprises members of NASA Glenn Research Center, various university affiliates from the State of Ohio, and a number of participating industrial partners. Funding is jointly provided by NASA, the State of Ohio, and industrial members. The work described here is a collaborative arrangement between researchers at Glenn, the University of Minnesota, The National Institute of Standards and Technology (NIST), and the Cleveland State University. Actual device fabrication is conducted at Glenn and at the laboratories of Case Western Reserve University. Case Western is also located in Cleveland, Ohio, and is a participating member of the initiative. The principal investigator for this project is Paul S. Greenberg of Glenn.

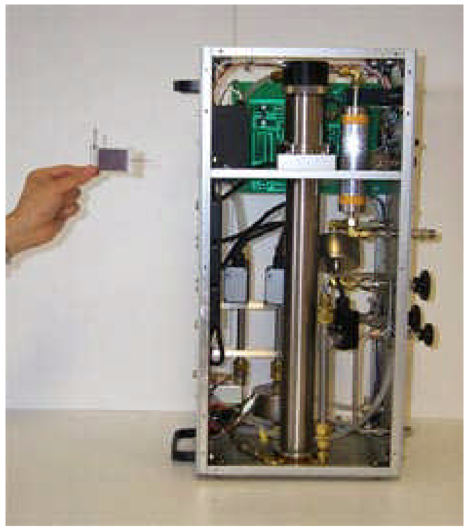
Two basic types of devices are being developed, and target different ranges of particle sizes. The first class of devices, which is used to measure nanoparticles (i.e., particles in the range of 0.002 to 1 mm), is based on the technique of Electrical Mobility Classification. This technique also affords the valuable ability of measuring the electrical charge state of the particles. Such information is important in the understanding of agglomeration mechanisms and is useful in the development of methods for particle repulsion. The second type of device being developed, which utilizes optical scattering, is suitable for particles larger than 1 mm. This technique also provides information on particle shape and composition.

Applications for these sensors include fundamental planetary climatology, monitoring and filtration in spacecraft, human habitation modules and related systems, characterization of particulate emissions from propulsion and power systems, and as early warning sensors for both space-based and ter-restrial fire detection. These devices are also suitable for characterizing biological compounds such as allergens, infectious agents, and biotoxic agents.



MiPAC cutoff voltage versus particle size. Flow rate, 203 cm^3/min.

The project team recently demonstrated the performance of a prototype microscale electrical mobility classifier, which is intended for applications to particles as small as a few nanometers. Excellent agreement was observed between modeling calculations and the observed performance.



Prototype microscale electrical mobility classifier shown with conventional macroscale device.

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